| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/678,254 | KAJIYAMA ET AL. | |
| | Examiner | Art Unit | |
| | ALEXANDER SOFOCLEOUS | 2824 | |

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *Election filed July 24, 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-77* is/are pending in the application.

4a) Of the above claim(s) *10-18,26-33 and 37-77* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8,19-24,34 and 36* is/are rejected.

7)☒ Claim(s) *9,25 and 35* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/6/03, 9/8/09, 10/1/09*.
4) ☒ Interview Summary (PTO-413) Paper No(s)/Mail Date. *20091120*.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

**DETAILED ACTION**

1. This action is responsive to the following communication: the Election filed July 24, 2009.

2. Claims 1-77 are pending. Claims 10-18, 26-33, and 37-77 are withdrawn from consideration Claims 1, 19, and 34 are independent.

***Election/Restrictions***

3. Applicant's election of Species I (claims 1-9, 19-25, and 34-36) in the reply filed on July 24, 2009 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Claims 10-18, 26-33, and 37-77 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim.

However, it is noted that claims 10-18 depend from elected claim 1 and claims 26-33 depend from elected claim 19, and should claims 1 and 19 be later found in condition for allowance claims 10-18 and 26-33 may be considered for rejoinder.

***Claim Rejections - 35 USC § 102***

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed

publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. **Claims 1, 2, 4, 5, 19, 21, and 22 are rejected under 35 U.S.C. 102(e) as being anticipated by Chen '913 (U.S. Patent 6,627,913).**

**Regarding independent claim 1**, Chen '913 shows a magnetic memory device (Fig. 16) comprising:

a first write wiring (Fig. 4: 18) formed to extend in a first direction,

a first magneto-resistance element (Fig. 4: 10) arranged above the first write wiring (Fig. 4: 18), and

a passivation film (Fig. 4: 40; the blanket layer of spacer material 40 is presently considered to meet the recited "passivation layer") formed thinner than the first write wiring (see Fig. 4: layer 42 appears pictorially represented as thinner than 18; but also see column 4, lines 33-35 defining thickness of blanket layer to a minimum value of 5nm) and disposed on the first magneto-resistance element (Fig. 4: 10).

**Regarding dependent claim 2**, Chen '913 discloses the passivation film (Fig. 4: 40) is a DLC (Diamond Like Carbon) film (column 4, line 40).

**Regarding dependent claim 4**, Chen '913 shows the first magneto-resistance element is an MTJ element (Fig. 4: 10; the TMR cell is an MTJ) which includes at least a first fixed layer (Fig. 4: 14; while not expressly recited as the fixed layer, the cell 10

has a fixed layer), a first free layer (Fig. 4: 16; while not expressly recited as the free layer, the cell 10 has a free layer) and a first tunnel insulating film (Fig. 4: 12) sandwiched between the first fixed layer and the first free layer.

**Regarding dependent claim 5**, Chen '913 shows the first free layer is formed in contact with the passivation film (see Fig. 4: 40 contacts layer 16).

**Regarding independent claim 19**, Chen '913 shows a magnetic memory device comprising:

a first write wiring (Fig. 4: 18) formed to extend in a first direction,

a first magneto-resistance element (Fig. 4: 10) arranged above the first write wiring (Fig. 4: 18), and

a passivation film (Fig. 4: 42) formed of a DLC film (column 4, line 40) on the first magneto-resistance element (Fig. 4: 10).

**Regarding dependent claim 21**, Chen '913 shows the first magneto-resistance element is an MTJ element (Fig. 4: 10; the TMR cell is an MTJ) which includes at least a first fixed layer (Fig. 4: 14; while not expressly recited as the fixed layer, the cell 10 has a fixed layer), a first free layer (Fig. 4: 16; while not expressly recited as the free layer, the cell 10 has a free layer) and a first tunnel insulating film (Fig. 4: 12) sandwiched between the first fixed layer and the first free layer.

**Regarding dependent claim 22**, Chen '913 shows the first free layer is formed in contact with the passivation film (see Fig. 4: 40 contacts layer 16).

6. **Claims 1, 4, 5, and 6 are rejected under 35 U.S.C. 102(b) as being**

**anticipated by Chen et al. '803 (U.S. Patent 6,165,803).**

**Regarding independent claim 1**, Chen et al. '803 show a magnetic memory device (Fig. 12, 13) comprising:

a first write wiring (Fig. 12: 29) formed to extend in a first direction,

a first magneto-resistance element (Fig. 12: 43) arranged above the first write wiring (Fig. 12: 29), and

a passivation film (see Fig. 12, 13: 76) formed thinner (see Fig. 12, 13: insulating layer 76 is pictorially represented as thinner above the MRAM than the write wiring 29) than the first write wiring (Fig. 12: 29) and disposed on the first magneto-resistance element (Fig. 12, 13: 76 is on top of 43).

**Regarding dependent claim 4**, Chen et al. '803 show the first magneto-resistance element is an MTJ element (see Fig. 12: 43) which includes at least a first fixed layer (see e.g., Fig. 7: 40 with respect to column 5, line 12), a first free layer (see e.g., Fig. 7: 42a with respect to column 5, line 13) and a first tunnel insulating film (see e.g., Fig. 7: 41 with respect to column 5, lines 14 and 16) sandwiched between the first fixed layer and the first free layer.

**Regarding dependent claim 5**, Chen et al. '803 show the first free layer (Fig. 7: 42a) is formed in contact with the passivation film (Fig. 12: 76; the free layer 42a is in contact with the insulating film 76 through bit line 70).

**Regarding dependent claim 6**, Chen et al. '803 show a second write wiring (Fig. 12: 70) formed between the first magneto-resistance element (Fig. 12: 43) and the passivation film (Fig. 12: 76) to extend in a second direction different from the first

direction (see Fig. 12, 13: bit line 70 and insulating film 76 are perpendicular to digit line 29).

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. **Claims 2, 7, 19, and 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. '803 (U.S. Patent 6,165,803) in view of Kurokawa et al. (IEEE Transactions on Magnetics "Application of Diamond Like Carbon Films to Metallic Thin Film Magnetic Recording Media").**

**Regarding dependent claims 2 and 7**, Chen et al. '803 teach the limitations supra claim 1 and 6, respectively.

Chen et al. '803 are silent with respect to the specific provision that the insulating layer (Fig. 12 and 13: dielectric layer 76, which is presently considered to meet the recited "passivation film") is a DLC (Diamond Like Carbon) film.

Kurokawa et al. teach utilizing diamond like carbon films as a protective layer (considered to meet the recited "passivation film") for magnetic media. While Kurokawa et al. expressly teach protecting magnetic tape, one of ordinary skill in the art would have appreciated its applicability as a protective layer for other magnetic media, such as magnetic thin film static memories.

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply the teachings of Kurokawa et al. to the teachings of Chen et al. such that diamond like carbon film is used as the insulating layer for the purpose of providing a protective layer that has high mechanical hardness and chemical stability.

**Regarding independent claim 19**, Chen et al. '803 teach a magnetic memory device (Fig. 12, 13) comprising:

a first write wiring (Fig. 12: 29) formed to extend in a first direction,

a first magneto-resistance element (Fig. 12: 43) arranged above the first write wiring (Fig. 12: 29), and

a passivation film (see Fig. 12, 13: 76; insulating layer 76) on the first magneto-resistance element (Fig. 12, 13: 76 is on top of 43).

Chen et al. '803 are silent with respect to the specific provision that the insulating layer (Fig. 12 and 13: dielectric layer 76, which is presently considered to meet the recited "passivation film") is a DLC (Diamond Like Carbon) film.

Kurokawa et al. teach utilizing diamond like carbon films as a protective layer (considered to meet the recited "passivation film") for magnetic media. While Kurokawa et al. expressly teach protecting magnetic tape, one of ordinary skill in the art would have appreciated its applicability as a protective layer for other magnetic media, such as magnetic thin film static memories.

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply the teachings of Kurokawa et al. to the teachings of Chen et al. such that diamond like carbon film is used as the insulating layer for the purpose of providing

a protective layer that has high mechanical hardness and chemical stability (see page 2410, Abstract)

**Regarding dependent claim 21**, Chen et al. '803 further teach the first magneto-resistance element is an MTJ element (see Fig. 12: 43) which includes at least a first fixed layer (see e.g., Fig. 7: 40 with respect to column 5, line 12), a first free layer (see e.g., Fig. 7: 42a with respect to column 5, line 13) and a first tunnel insulating film (see e.g., Fig. 7: 41 with respect to column 5, lines 14 and 16) sandwiched between the first fixed layer and the first free layer.

**Regarding dependent claim 22**, Chen et al. '803 further teach the first free layer (Fig. 7: 42a) is formed in contact with the passivation film (Fig. 12: 76; the free layer 42a is in contact with the insulating film 76 through bit line 70).

**Regarding dependent claim 23**, Chen et al. '803 further teach a second write wiring (Fig. 12: 70) formed between the first magneto-resistance element (Fig. 12: 43) and the passivation film (Fig. 12: 76) to extend in a second direction different from the first direction (see Fig. 12, 13: bit line 70 and insulating film 76 are perpendicular to digit line 29).

9. **Claims 1-8, 19-24, 34, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Durcan et al. (U.S. Patent 6,682,943) in view of Kurokawa et al. (IEEE Transactions on Magnetics "Application of Diamond Like Carbon Films to Metallic Thin Film Magnetic Recording Media").**

**Regarding independent claim 1**, Durcan et al. teach a magnetic memory

device (Fig. 20) comprising:

a first write wiring (Fig. 20: 66) formed to extend in a first direction,

a first magneto-resistance element (Fig. 20: 91, 80, 92) arranged above the first write wiring (Fig. 20: 66). Durcan et al. further teach the first wiring layer is formed in grooves that are from 50nm-200nm, but preferably 100nm (see column 5, lines 27-29).

Durcan et al. are silent with respect to a passivation film formed thinner than the first write wiring and disposed on the first magneto-resistance element.

Kurokawa et al. teach a protective coating (considered to meet the recited "passivation film") for magnetic memory media (page 2410 abstract) that has a thickness of 10nm (see page 2412, Application To Magnetic Recording Media). This thickness presently appears to be thinner than the Durcan et al. first write wiring layer.

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply the teachings of Kurokawa et al. to the teachings of Durcan et al. such that protective film is used over the magneto-resistance memory for the purpose of at least providing a protective surface to protect the memory (see page 2410, Abstract).

**Regarding dependent claim 2**, Kurokawa et al. further teach the passivation film is a DLC (Diamond Like Carbon) film (see page 2412, Application To Magnetic Recording Media).

**Regarding dependent claim 3**, the combination of Durcan et al. and Kurokawa et al. teach a total film thickness of the first magneto-resistance element and the passivation film is not larger than 50 nm (Kurokawa et al. teach the DLC layer of 10nm and Durcan et al. teach the magneto-resistance element has a preferred thickness of

37.5nm; see Kurokawa et al. page 2412, Application To Magnetic Recording Media; see Durcan et al. column 6, lines 14-23, 30-32, and 44-47).

**Regarding dependent claim 4**, Durcan et al.further teach the first magneto-resistance element is an MTJ element (see e.g., Fig. 17: 79, 80, and 89 is the MTJ) which includes at least a first fixed layer (Fig. 17: 79), a first free layer (Fig. 17: 89) and a first tunnel insulating film (Fig. 17: 80) sandwiched between the first fixed layer and the first free layer.

**Regarding dependent claim 5**, the combination of Durcan et al. and Kurokawa et al. teach the first free layer (Fig. 17: 89) will be formed in contact with the passivation film (Kurokawa DLC film which is deposited over the memory media to protect it).

**Regarding dependent claim 6**, the combination of Durcan et al. and Kurokawa et al. teach a second write wiring (Durcan et al. Fig. 20: 93) formed between the first magneto-resistance element (see Durcan et al. Fig. 20: 91, 80, 92) and the passivation film (Kurokawa DLC film) to extend in a second direction different from the first direction (the protective coating having a thickness would have covered the entire device and thus extends in all directions including a second direction different that the first direction).

**Regarding dependent claim 7**, Kurokawa et al. further teach the passivation film is a DLC film (see page 2412, Application To Magnetic Recording Media).

**Regarding dependent claim 8**, Durcan et al. further teach the second write wiring (Fig. 20: 93) is thinner (while the Figures may not necessarily be exactly to scale, there is a significant pictorial difference in thickness of layer 93 and 66 which appears to

indicate that 93 would have been thinner than 66) than the first write wiring (Fig. 20: 66).

**Regarding independent claim 19**, Durcan et al. teach a magnetic memory device (Fig. 20) comprising:

a first write wiring (Fig. 20: 66) formed to extend in a first direction,

a first magneto-resistance element (Fig. 20: 91, 80, 92) arranged above the first write wiring (Fig. 20: 66).

Durcan et al. are silent with respect to a passivation film on the first magneto-resistance element.

Kurokawa et al. teach a protective coating (considered to meet the recited "passivation film") for magnetic memory media (page 2410 abstract).

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply the teachings of Kurokawa et al. to the teachings of Durcan et al. such that protective film is used over the magneto-resistance memory for the purpose of at least providing a protective surface to protect the memory (see page 2410, Abstract).

**Regarding dependent claim 20**, the combination of Durcan et al. and Kurokawa et al. teach a total film thickness of the first magneto-resistance element and the passivation film is not larger than 50 nm (Kurokawa et al. teach the DLC layer of 10nm and Durcan et al. teach the magneto-resistance element has a preferred thickness of 37.5nm; see Kurokawa et al. page 2412, Application To Magnetic Recording Media; see Durcan et al. column 6, lines 14-23, 30-32, and 44-47).

**Regarding dependent claim 21**, Durcan et al.further teach the first magneto-resistance element is an MTJ element (see e.g., Fig. 17: 79, 80, and 89 is the MTJ)

which includes at least a first fixed layer (Fig. 17: 79), a first free layer (Fig. 17: 89) and a first tunnel insulating film (Fig. 17: 80) sandwiched between the first fixed layer and the first free layer.

**Regarding dependent claim 22**, the combination of Durcan et al. and Kurokawa et al. teach the first free layer (Fig. 17: 89) will be formed in contact with the passivation film (Kurokawa DLC film which is deposited over the memory media to protect it).**Regarding dependent claim 23**, the combination of Durcan et al. and Kurokawa et al. teach a second write wiring (Durcan et al. Fig. 20: 93) formed between the first magneto-resistance element (see Durcan et al. Fig. 20: 91, 80, 92) and the passivation film (Kurokawa DLC film) to extend in a second direction different from the first direction (the protective coating having a thickness would have covered the entire device and thus extends in all directions including a second direction different that the first direction).

**Regarding dependent claim 24**, Durcan et al. further teach the second write wiring (Fig. 20: 93) is thinner (while the Figures may not necessarily be exactly to scale, there is a significant pictorial difference in thickness of layer 93 and 66 which appears to indicate that 93 would have been thinner than 66) than the first write wiring (Fig. 20: 66).

**Regarding independent claim 34**, Durcan et al. teach a magnetic memory device (Fig. 20) comprising:

a first magneto-resistance element (Fig. 20: 91, 80, 92),

a first read wiring (Fig. 20: 93) formed on the first magneto-resistance element (Fig. 20: 91, 80, 92),

a second read wiring (Fig. 20: 66) connected to the first read wiring (Fig. 20: 93 is connected to 66 through the MRAM), disposed below the first read wiring (Fig. 20: 93) and formed thicker (while the Figures may not necessarily be exactly to scale, there is a significant pictorial difference in thickness of layer 93 and 66 which appears to indicate that 66 would have been thicker than 93) than the first read wiring (Fig. 20: 93).

Durcan et al. are silent with respect to a passivation film on the first read wiring.

Kurokawa et al. teach a protective coating (considered to meet the recited "passivation film") for magnetic memory media (page 2410 abstract).

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply the teachings of Kurokawa et al. to the teachings of Durcan et al. such that protective film is used over the magneto-resistance memory for the purpose of at least providing a protective surface to protect the memory (see page 2410, Abstract).

**Regarding dependent claim 36**, Kurokawa et al. further teach the passivation film is a DLC (Diamond Like Carbon) film (see page 2412, Application To Magnetic Recording Media).

***Allowable Subject Matter***

10. **Claims 9, 25, and 35 are objected to as being dependent upon a rejected base claim**, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

11. The following is a statement of reasons for the indication of allowable subject

matter:

**With respect to dependent claim 9**, there is no teaching, suggestion, or motivation for combination in the prior art to a total film thickness of the first magneto-resistance element, the second write wiring and the passivation film is not larger than 50 nm, in combination with intervening limitations.

**With respect to dependent claim 25**, there is no teaching, suggestion, or motivation for combination in the prior art to a total film thickness of the first magneto-resistance element, the second write wiring and the DLC passivation film is not larger than 50 nm, in combination with intervening limitations.

**With respect to dependent claim 35**, there is no teaching, suggestion, or motivation for combination in the prior art to a total film thickness of the first magneto-resistance element, the first read wiring and the passivation film is not larger than 50 nm, in combination with intervening limitations.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

## CONCLUSION

The prior art made of record and not relied upon is considered pertinent to

applicant's disclosure: Hosomi (U.S. Patent Application Publication 2003/0011944), Nishimura et al. (U.S. Patent 6,487,110), Okayama et al. (U.S. Patent 7,336,556), Min et al. (U.S. Patent 7,394,122)

Homosi shows a GMR with a thickness of about 44nm and upper and lower electrodes that each having a thickness of 300nm.

Nishimura et al. show an MRAM with an insulating film formed as a protective film.

Okayama et al. show an MRAM with a passivation layer.

Min et al. show an MRAM with thin write lines.

When responding to this office action, applicants are advised to provide the examiner with the line numbers and page numbers in the application and/or references cited to assist the examiner in locating appropriate paragraphs.

A shortened statutory period for response to this action is set to expire three months and zero days from the date of this letter. Failure to respond within the period for response will cause this application to become abandoned (see MPEP 710.02(b)).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alexander Sofocleous whose telephone number is 571-272-0635. The examiner can normally be reached on 7:00am - 4pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Elms can be reached on 571-272-1869. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/ALEXANDER SOFOCLEOUS/
Examiner, Art Unit 2824
AGS